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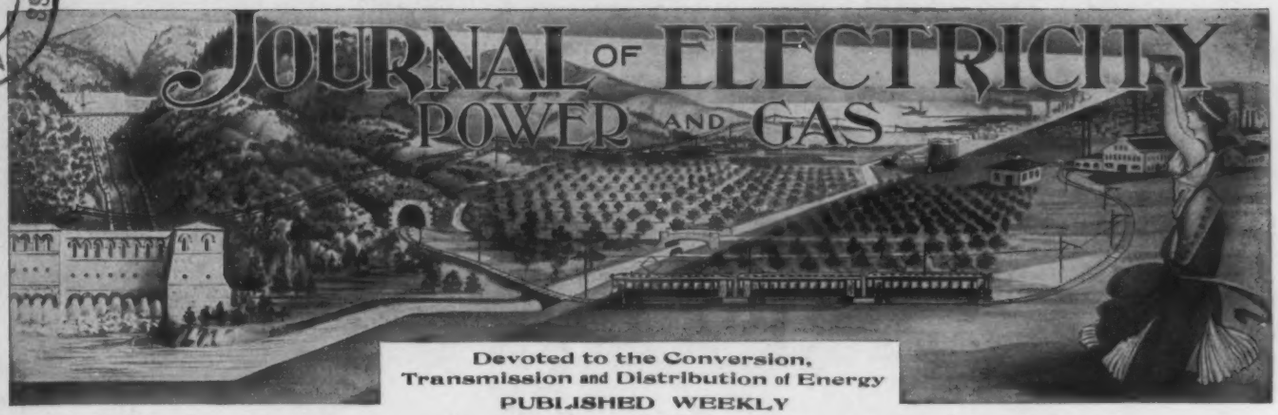

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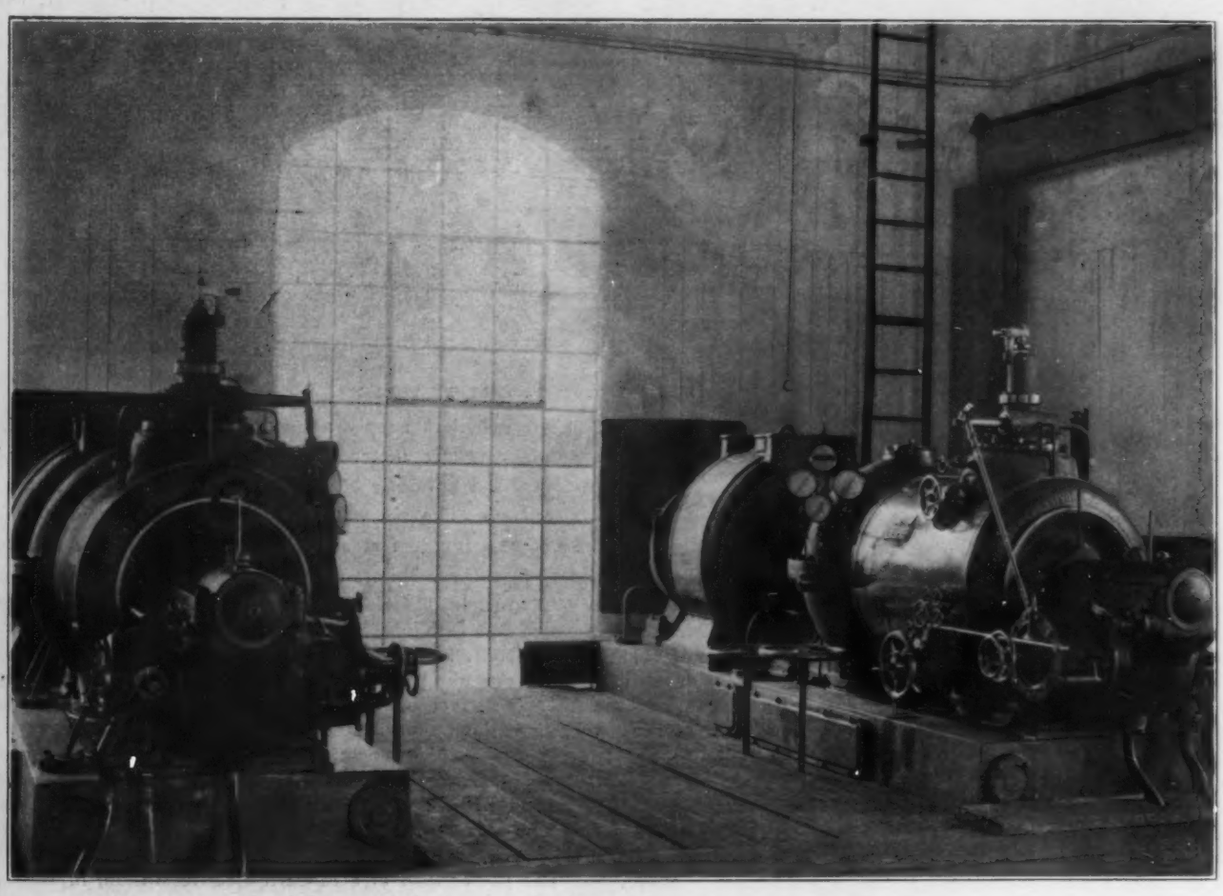
Journal of Electricity, Power and Gas

Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XX. SAN FRANCISCO, CAL., APRIL 25, 1908 No. 17

MODERN GERMAN STEAM TURBINE PLANTS.

It may be of interest to consider some of the latest installations of steam turbines in German power plants and central stations, as well as the construction, method of operation, and economy of these new prime movers as compared with the latest types of reciprocating engines. It is generally conceded that where additional power is found desirable, either in the central station of a large city or town or in the power plant of a large manufacturing establishment, and the space is limited, the steam turbo-generator can usually be installed to advantage on account of the small amount of space it requires. This information has been compiled by Frank C. Perkins.



STEAM TURBINE AT CENTRALE WIK, GERMAN MARINE.

At the Centrale Wik of the German Marine, two steam turbine units have recently been installed, of three hundred horsepower capacity each, as shown in the accompanying illustration. These German steam turbine sets were placed in operation in March, 1908, by Melms & Pffeniger, G. M. B. H., of Munchen. A similar unit of 1,200 horsepower capacity, driving a direct-current electrical generator, has been installed at the Elektricitats Werk Bielefeld. All of these steam turbines are of the combination action and reaction type, which has been in successful operation at the power plant of the Maffei locomotive works in Bavaria.

It will be of interest to consider the performance of the latter modern steam turbine unit of 500 kilowatts capacity, constructed at the Eisenwerk Hirschau, Munich. This German steam turbo-dynamo outfit consists of two electrical generators of a continuous-current type, directly coupled to the 1,000-horsepower steam turbine shown in the photograph.

The design of this steam turbine is based on a combination of the reaction principle for the low-pressure part and the action or impulse principle for the high-pressure end of the turbine. The fixed guide blades are arranged for the admission of steam only over a small portion of the circumference at the high-pressure end of the turbine. The

partial-admission system is therefore utilized on this portion of the turbine, and hence the diameter of the drum is made large at the high-pressure end, and there is a step-down from this section to the first part of the reaction turbine, which is of smaller diameter, and it is maintained that the annular surface thus formed enables the axial thrust of the steam due to the reaction portion to be balanced very easily.

It is also held that the adoption of the impulse principle for the steam turbine high-pressure end greatly reduces the length of the drum, and its form also reduces the cost of construction over that of the reaction turbine of usual design. It is also stated that as the casing is shorter, the difference of temperature does not give rise to the serious troubles known as "hogging," and "whipping" of the drum is also avoided, as the diameter is large. It is also claimed that the number of blades necessary is greatly reduced as compared with ordinary reaction turbine.

It may be stated that the theoretical efficiency of the reaction steam turbine is superior to that of the impulse turbine, as far as friction losses are concerned, in the absence of leakage losses, but these German engineers hold that at the high-pressure end of the reaction steam turbine this superiority does not exist, as there is a larger loss of leakage on account of the clearances required at the blade tips.

engine working at constant load and at their highest economy.

Steam turbines are used for supplementing the reciprocating engines at the Frankfort Electricity Works, which has a total capacity of 15,000 kilowatts, the boiler installation supplying steam for the turbines and reciprocating engines including twelve Kuhn internal flue boilers, with Galloway tubes, and six automatically fired Munkner water-tube boilers of the Simonis & Lanz construction, the former boilers having transverse drums and Tenbrink grates.

The ash conduit with rail track is under the boiler-house floor, and the main flue is behind the boilers, having a cross section of about four square meters. The chimney is nearly ten feet in diameter at the top, and measures 165 feet in height. The coal bunker is 120 meters long, about 39 feet wide, and 19½ feet high, and the feed water supplied from the city water works is stored in a masonry tank of 46,000 cubic feet capacity, injectors being used for feeding the hot water tanks from the storage tank.

The twelve Kuhn boilers of the internal type each have a grate surface of 925 square feet, the boilers being 28.5 feet long and 8.25 feet in diameter, with flue 4.25 feet in diameter, constructed of corrugated plates. A steam dome 3 feet in diameter and 3.95 feet high is provided on each boiler, with the necessary stop and safety valves.

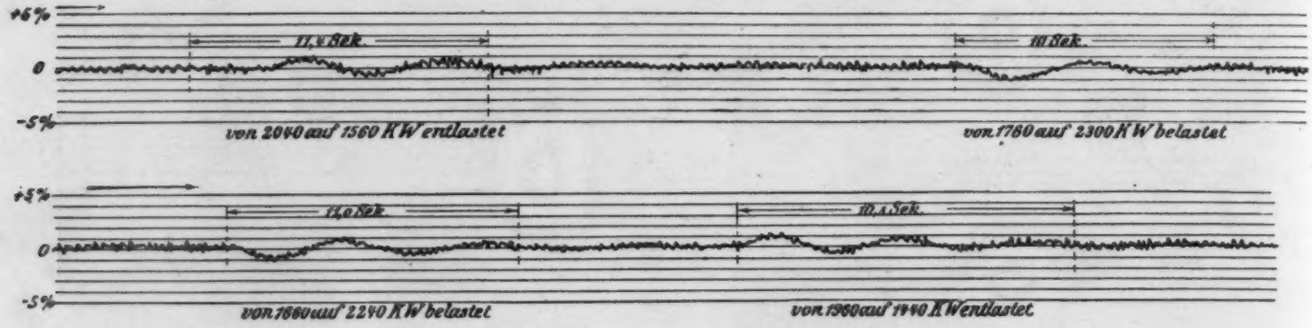



FIG. 2. SPEED VARIATION CURVES OF FRANKFORT TURBINE.

It is claimed that the adoption of the impulse system for the high-pressure end of the turbine and the reaction principle for the low-pressure end has given a combination steam turbine unit having the lowest steam consumption for a similar output which has yet been obtained.

It may be of interest to note the results of a test made by Professor Schroeter, of Munich, on this 500-kilowatt mixed type of steam turbine under various conditions of load. The two generators driven by this 1,000-horsepower Melms-Pfenninger-Sanker steam turbine each have a capacity of 250 kilowatts, and when operating under full load, supplying 500 kilowatts during the test, the speed average was 2,459 revolutions per minute, with an absolute steam pressure at the stop valve of the turbine of 191 pounds per square inch. The steam consumption was found to be 17.1 pounds per kilowatt hour, 8,570 pounds being the total steam consumption per hour. The steam pressure during this test was 176 pounds above atmosphere, while the actual temperature of the steam was 319.4 degrees C., or 607 degrees F.

The larger central stations in Germany, as well as in many other European countries, are now equipped with steam turbines as supplementary equipment to reciprocating engine units wherever additional power is required, particularly where space is limited and other conditions make the steam turbo-alternator a desirable adjunct to the plant.

The wonderful success in using these turbo-alternators in parallel with slow-speed alternators driven by reciprocating engines makes them most desirable where extra power is found necessary, due to a high peak load. The steam turbine and generator act as a great storage battery, readily supplying power far above their rated capacities during short periods. It is also noted that these high-speed units take the peak of the load automatically, leaving the slow-speed steam

These boilers supply a maximum of 60 pounds of dry steam per square meter of heating surface at 135 pounds pressure, and normally 38 pounds per square meter of heating surface. The six water-tube boilers each have a grate area of 48.5 square feet and a total heating surface of 3,340 square feet, these boilers each having two drums 20 feet long and 1.15 feet in diameter, with steam domes 2.3 feet in diameter and 2.75 feet in height.

In addition to the above boiler equipment, there are six other water-tube boilers of the Steinmuller type, each having a heating surface of 3,350 square feet, which can be utilized with or without superheaters, the latter each having a surface of 775 square feet. These boilers are equipped with electrically operated automatic stoking apparatus of the Leach type, and when the boilers are operating with superheaters give 1.85 pounds of steam, at 300 degrees C., per square foot per hour at 150 pounds steam pressure.

The power load of a modern electric station, in Europe as in America, includes not only the commercial motor service, but frequently traction service as well, the former utilizing single-phase or two or three phase motors ranging from 110 to 150 horsepower, and when direct current is available, 110-volt, 220-volt, or 500-volt continuous-current motors of about the same sizes. The traction service is usually 500-volt direct current, although the single-phase and polyphase railway systems coming into use call for current supplied to induction motors and other alternating types.

At the Frankfort Electricity Works, located on the River Maine, there are four 1,500-horsepower units and four 750-horsepower units, the generators all being of the single-phase type constructed by Brown, Boveri & Co., of Baden, Switzerland. The four 750-horsepower engines are of the tandem

compound type built at Stuttgart by G. Kuhn, and are operated at 120 pounds initial pressure and at 85 revolutions per minute, developing a normal power of 560 brake horsepower and a maximum of 750 brake horsepower.

The increased lighting load is 7,000 kilowatts, and the increased power load at this station is being taken care of by two 5,000-horsepower steam turbines of the Brown-Boveri type, directly coupled to alternators, which are driven at a speed of 1,360 revolutions per minute, the speed curves being seen in Fig. 2. These steam turbines work with superheated steam at 300 degrees C. and at 135 pounds, supplementing the 750-horsepower reciprocating steam engines above referred to, as well as the four 1,500-horsepower reciprocating engines of the Sulzer type, operating at 85 revolutions per minute.

Steam turbines are now finding a special field in increasing the capacity of stations, by using the exhaust steam from large reciprocating engines and working under a vacuum when plenty of condensing water is available. The capacity of a station can be readily increased by their use, even where but limited floor space is available.

At the Frankfort station the engine room measures 75 feet by 282 feet, its height being 34 feet from the floor to the eaves, and the boiler room is 395 feet long and 59 feet wide.

The largest engines when tested showed a steam consumption of 14 pounds with a load of 1,408 brake horsepower, and at about three-fourths and one-half load of 1,073 horsepower and 705 horsepower; the steam consumption was 13.85 pounds and 13.55 pounds per indicated horsepower per hour.

As a result of tests at the Frankfort steam turbine installation, with a steam pressure of 10.6 atmospheres and steam superheated to a temperature of 312 C. the steam consumption was found to be 14.75 pounds per effective kilowatt-hour with a load of 2,995 kilowatts. This 5,000-horsepower steam turbine was guaranteed to drive the alternators at an output of 2,600 kilowatts on a steam consumption of 15.9 pounds per e. kilowatt-hour, with a steam pressure of 12.8 atmospheres and 300 degrees C. superheat. On a test it was found that the unit when operating at a load of 1,945 kilowatts and supplying with steam at a pressure of 12.63 atmospheres and 2.98 degrees C. superheat, the steam consumption was 15.9 pounds when the load was increased to 2,518 kilowatts, the steam pressure being 12.8 atmospheres and the superheated steam having a temperature of 295 degrees C. There is every reason to believe that the future has much in store for the steam turbine for the generation of electric power on account of its economy of operation, small amount of space required, and low cost of construction for the electrical generator to which it is directly connected.

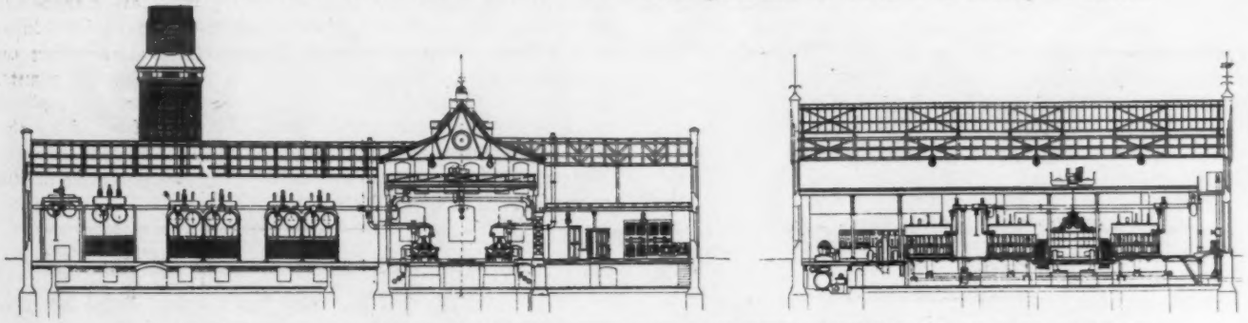


FIG. 3. ONE TURBINE SET SUPPLEMENTING SIX RECIPROCATING ENGINES AT ZENTRALE I, BREMEN, GERMANY.

In the basement of the engine room there is a steam collector taking steam from the twelve flue boilers, which is made in two sections, with a copper bend, the diameter of the collector being 2.08 feet, and valves are provided so that each section can be shut off separately when desired.

The ring system of the steam piping is used for the water-tube boilers instead of collectors, this piping, however, communicating with the collectors at convenient points, steam-drying apparatus being inserted and the valves installed so that each engine and each boiler can be disconnected from the main steam pipe at will.

The 750-horsepower engines of the Kuhn type are fitted with Kuchenbecker valve gear and may be operated as non-condensing engines or condensing engines, as desired.

These engines have a stroke of 3.96 feet, and high-pressure and low-pressure cylinders, measuring 2.08 feet and 3.16 feet in diameter respectively. These engines measure 4.85 feet and 8.1 feet between bearings, and have a length of 3.04 feet from the end of the cylinders to the center of the crank shaft. The fly-wheel weighs 56,000 pounds, and is nearly 16.5 feet in diameter.

The 1,500-horsepower Sulzer engines have fly-wheels weighing 100,000 pounds, and are over 20 feet in diameter, with cylinders 3.22 feet and 4.13 feet in diameter respectively for the high and low pressures, the stroke being 4.95 feet in length. These engines are about 43 feet long, with bearings about 12.5 feet apart.

The steam consumption of the 750-horsepower engines during tests was found to be 15.4 pounds per indicated horsepower of 578 brake horsepower, while the consumption of the steam increases to 15.8 pounds per indicated horsepower per hour with a load of 760 brake horsepower.

The steam-consumption curves for the Frankfort steam turbine at 10 atmospheres pressure and 230 degrees C. and 300 degrees C. show a variation from somewhat above 22 pounds at 500 kilowatts to 16.8 pounds at 3,000 kilowatts. With a steam pressure of 14 atmospheres, varied from less than 10 kilograms at a trifle over 500 kilowatts load to as low as 14.6 pounds with an output of 3,000 kilowatts.

Many of the most important central stations in Germany, as well as in France, are now being equipped with steam turbines direct connected to alternating-current as well as direct-current dynamos, these turbine units being employed for supplementing the reciprocating steam engine sets of the slow-speed type.

Such an equipment is shown in the accompanying drawing (Fig. 3) of Zentrale I, or the main station on Schlachthofstrasse, in the city of Bremen, Germany.

Six of the vertical slow-speed engine sets are supplemented by the Parsons steam turbine, Brown, Boveri & Co., of Baden, Switzerland. This horizontal steam turbine has a capacity of 750 horsepower and operates at a speed of 2,100 revolutions per minute. It is directly coupled to two direct-current dynamos of 500 kilowatts for electric lighting and railway service.

The advantages of steam turbines as supplementary equipments are many. They occupy small space for a given output, and this is important in adding additional units where space for increased capacity of the plant is limited. They take care of variable loads with great satisfaction, and are capable of being overloaded for a short period of time at the peak of the load without injury. The steam turbines in taking up the variations in load similar to a storage battery allow the reciprocating slow-speed steam engine sets to

operate at constant load, therefore working with the highest economy at their maximum output.

Four of the vertical triple-expansion engines in this station are of the Schichau type, developing 320 horsepower at 120 revolutions per minute. They are each directly coupled to Siemens & Halske inner-pole type direct-current dynamos for lighting service.

The other two units are of the same type of engines, developing 380 horsepower each, and directly coupled to direct-current machines supplied by the Union Elektrizitats Gesellschaft.

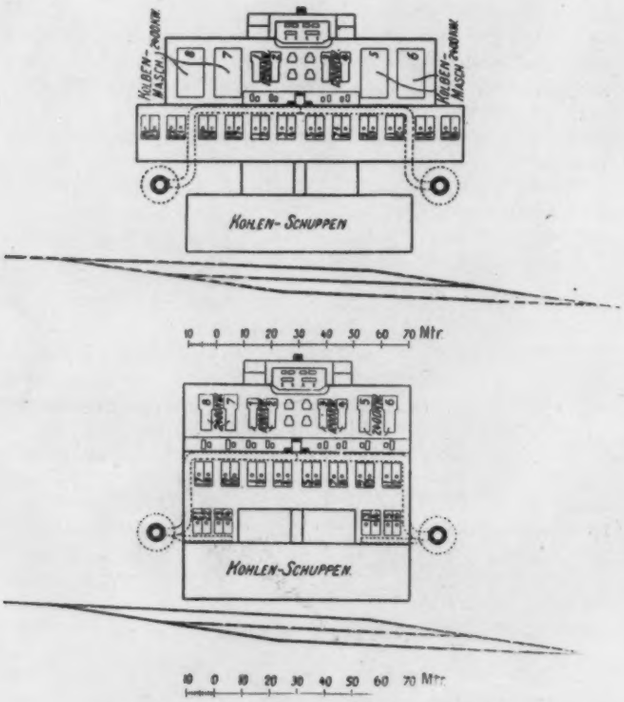


FIG. 4. ZENTRALE II, BREMEN, GERMANY.

This station has a total capacity of about 3,000 kilowatts, and it is provided with an accumulator plant consisting of two sets of 68 cells of storage battery, each having a capacity of 140 amperes discharge rate for three hours, for lighting service. There are 267 cells of battery provided for electric railway service, each having a capacity of 780 amperes discharge rate for one hour, the complete battery having a capacity of 130 kilowatts, with a three-hour discharge rate.

The new station of the Stadtischen Elektrizitats Werks, Bremen, equipped with a steam turbine exclusively, is shown in the accompanying drawing. The Zendrale II at Kastedt is equipped with 8 boilers, each having a heating surface of 300 square meters and supplying steam at a pressure of 12 atmospheres to the steam turbines, superheaters being provided for raising the temperature of the steam to 350 degrees C.

The steam turbine and generator room, as shown in the accompanying drawing, is equipped with 4 turbo-dynamos of the Zoelly type, constructed by Ecchers, Wyss & Co., of Zurich, Switzerland. These turbines each have a capacity of 1,200 kilowatts, driving three-phase alternators of this output constructed by the Siemens-Schuckert-Werk, of Berlin. The turbines operate at a speed of 1,500 revolutions per minute, and the Drehstrom dynamos supply a current of 7,500 volts pressure.

These turbo-alternator units have a total normal output of about 5,000 kilowatts. In order to show the difference in space required for steam turbine units as compared to reciprocating units for increasing the capacity of this plant to 14,400 kilowatts, it will be of interest to examine the accompanying drawings (Figs. 6 and 7), showing an addition of four sets of 2,400 kilowatts each, while the arrangement requires a much greater area for four vertical reciprocating engine sets of the same capacity.

In the center of the engine room of Central Station 11 at Bremen will be noted four rotary transformers or motor generator sets, of 100-kilowatt capacity each, for use in charging storage batteries located in the basement of the station under the switchboard equipment.

There is a unique and interesting sub-station and storage-battery plant at Grossen Hudestrasse, in Bremen, which is provided with three storage-battery installations, one having a capacity of 406 kilowatts, there being 138 cells, with a discharge rate of 1,584 amperes for three hours. There is another set of 138 cells, with an output of 318 kilowatts, or 1,242 amperes, while the third set consists of 144 cells of 260 kilowatts capacity, supplying a current of 972 amperes. The first two battery sets were installed by the Akkumulatorenfabrik A.-G., while the third battery was supplied by the Pfluger Akkumulatorenwerke A.-G.

In this sub-station there are three motor generator sets of 600 kilowatts capacity and three similar sets of 400 kilowatts output. Near the storage-battery installation there are two motor generator sets of 60 kilowatts and one of 110 kilowatts, these sets consisting of three machines operating on a common shaft for use in charging the storage-battery plants. The current is received at this sub-station as a three-phase alternating current at 7,500 volts, and is transformed by the motor generator sets to a direct current, with the storage-battery plants for regulation and for reserved power in taking care of the peak of the load.

MEXICAN TELEPHONE ENTERPRISE.

The following details of the first concession for wireless and long-distance telephone service in Mexico, forwarded by Special Agent A. B. Butman, are from the Mexican "Herald": The company, which is being formed with a capital of $1,000,000 Mexican currency ($500,000 American) to develop long-distance and wireless telephony between Mexico City and the port of Vera Cruz, is now being completed. The company is being organized through the efforts of Lic. Francisco Alfaro, who represents capitalists of London who are anxious to further the development of such an enterprise.

The concession for the establishing of long-distance as well as wireless stations in the section of the Republic between this capital and Vera Cruz has been obtained by Manuel S. de Corbera and Engineer J. Sitzenstatter, covering a period of fifty years, and including the building of lines in and between various towns, such as Vera Cruz, Cordoba, and Orizaba. In these towns underground cables and lines will be laid, over 5 kilometers (kilometer, .62 mile) of underground work having been laid already in the port of Vera Cruz. The wireless part of the concession will be developed later, the concessionaires now putting their attention to the stringing of wires between towns and the laying of underground cables in Vera Cruz. It is the ultimate intention to spread a network of wires throughout the State of Vera Cruz for the purpose of connecting the large rubber, coffee, sugar, and other plantations of that State with their center, their commercial district, Vera Cruz. Governor Teodoro A. Dehesa and his secretary of state, Lic. Eliezer Espinosa, are very greatly interested in the construction of adequate telephonic service as planned by the concessionaires, and the President of Mexico, General Porfirio Diaz, is assisting this important enterprise with many suggestions.

SINGLE PHASE RAILWAY.

San Francisco, Vallejo & Napa Valley Railroad.

(Concluded.)

Discussion by H. W. Crozier.

While discussing the present condition of this railroad, it may be of some interest to look into some of the difficulties which have been encountered and overcome. Their lessons may be of value in discussing new roads, and they surely exposed all the weak points of the motor.

In looking over the first six months of operation on this road, I am reminded of a lecture I heard many years ago. In discussing the d. c. railway motor, the lecturer took occasion to state that its principal development was in its mechanical construction. Our experience has been similiar with the alternating current motor. Most of its troubles were due to the failure of apparatus which had not been fully developed, and was not ample for the service to be performed. There were, of course, certain electrical features which, while not in themselves wrong, were unsatisfactory for the purpose. Our principal difficulties were with the mechanical operation of the apparatus.

The road extends from Vallejo to Napa, there being sixteen miles of track laid with sixty-pound rail on redwood ties, using dirt ballast. There was a small amount of gravel ballast at some points.

The overhead construction was similar to ordinary d. c. practice, and was supplied with 750 volts alternating current by five transformers, located at approximately equal distances. A 6600 volt transmission line of No. 2 copper fed the transformers. The track was bonded with 4/0 plastic bonds.

The station equipment consisted of two 400 kilowatt two-phase generators, mounted on the same shaft, with three-phase induction motors, which were furnished with power from the Bay Counties Power Co.

A Tirrill regulator took care of the violent voltage fluctuations in a very satisfactory manner.

The generators being wound for 6600 volts, fed directly to the transmission line. The station machinery operated nicely and required but little attention.

The alternating current motor in itself gave us very little trouble, but was so hedged around with apparatus that either limited the current supply or would not operate satisfactorily, that the alternating current motor did not get a fair show. Of course, the motor was the new and the supposedly experimental thing, and it had to bear on its weak shoulders all the defects of its auxiliaries and their failures.

A word as to the motor, and later we will discuss the auxiliaries. We used to cuss them.

You are all undoubtedly familiar with the general construction of the motor. It is very similar in design and in operation to a d. c. series motor, with commutating poles, and operates almost the same. The armature has a d. c. winding of the usual form, with the addition of German silver resistance leads running from the ends of the winding to the commutator. The commutator is on what is usually designated the back end of the armature, and the resistance leads are taken through the armature core in the bottom of the slots. The office of these resistance leads is to limit the flow of current in the coils short-circuited by the brushes. There are four groups of brushes, which are made as narrow as possible.

The field is made up of punchings, and is of the four-pole type. There is in addition to the winding on the pole pieces, a second winding distributed in slots in the pole faces, and arranged so as to have its magnetizing effect forty-five mechanical degrees behind the main poles or in the space between them. This second winding, called the compensating winding, is permanently connected in series, with the brushes and the armature, and is reversed when the armature is reversed.

The motors operated generally satisfactorily, and while their torque in the earlier operation of the road was quite defective, it improved as the conditions improved. Sparking, supposed to be the great bugbear, was almost imperceptible, and never at any time gave us any trouble. The commutators operated beautifully, as far as commutation and other such matters were concerned. Mechanically, however, they were weak, being made up with fish paper between the bars. Under the influence of the considerable temperature which the commutators would attain, and also the high velocity at which they were run, they failed after about two or three months' service by throwing the fish paper out from between the bars.

The resistance leads would also burn off at various times, but I ascribe this trouble as due to the low voltage which was applied to the motors, causing them to start very slowly. If the car did not start promptly, a very considerable current would flow in the German silver leads and they would fail.

A peculiar feature of this motor was the fact that it would run right along with a dozen or so resistance leads burned off, and we would know nothing of the matter until the inspector would find the defect at night. The re-winding was difficult, and attempts at re-winding made in San Francisco were unsuccessful. Usually armatures re-wound would fail by bursting the bands, until satisfactory band-wire could be obtained from the factory.

In addition to the motors, the car equipment consisted of the following auxiliaries: A transformer, a circuit-breaker, a reverser, an induction-regulator, an air pump and transformer, two master controllers, and a seven cell storage battery. The power-circuit from the trolley went directly through a fuse to the circuit-breaker, and a tap was taken off for the air pump transformer, which also supplied current for the lights.

The circuit-breaker, reverser and induction regulator were operated by compressed air, distributed by magnetically operated valves, electrically connected to the controller, and so interlocked that each performed its functions at the proper time. The induction regulator was fitted with a complete three cylinder air engine, controlled by two air-operated slide valves, in turn controlled by the magnet valves. As for the circuit-breaker, suffice it to say that it was fearfully and wonderfully made, and that it would do nearly everything else but circuit-break.

The power supply to the motors was taken off a 210 volt tap in the transformer winding, and was conducted through the secondary of the induction regulator to the reverser, and thence to the motors. The induction regulator added or subtracted fifty volts, depending on its position, and the motors received 160 volts at start and 260 volts at highest point.

The general operating of this auxiliary apparatus was unsatisfactory from start, until it was replaced by better. The circuit-breaker gave out completely on the first trial, and was finally doctored up by completely swathing all the parts with asbestos, so that it could not burn up. By replacing the asbestos, we made the circuit-breakers operate after a fashion. The induction regulator valves had a bad habit of sticking when least expected, and would leave the car stranded on account of the interlocking, leaving the control circuit open. The air motor consumed a large quantity of air, and kept the pump working hard nearly all the time. The reverser would stick occasionally, so as to keep every one guessing. Fortunately, these things would occur one after the other, so that we had a chance to think out remedies, but they occurred frequently enough to keep everybody on the jump all the time.

About June 1st, the locomotive was tried out, and after getting all the motors to run the same way, was taken out on the road. The circuit-breaker promptly burned out, and we got home by a judicious use of the trolley rope. An oil switch, taken from the switchboard, was put on the locomotive temporarily, and the circuit-breaker repaired. The motors only

exerted a small amount of starting torque. This was due to the fact that the gears were of quite small ratio. New gears were sent by express, and after their arrival the locomotive did much better, and was able to climb the seven per cent grade in Vallejo. One of the transformers near Vallejo was found to be too far from this seven per cent grade, and it was moved to a lot in town at the head of the grade.

By this time the first of the passenger cars was ready, and on the 4th of July operations were started, using one passenger coach, and the locomotive and the trailer. Everything went along satisfactorily until about 2 P. M., when the air hose, which is inserted between the air pump and the car piping, melted off on both the passenger car and the locomotive at about the same time. This was partly due to the high temperature and partly due to the continuous work the motor had to do. As the controllers were operated by air, this put the road completely out of business. We had taken the precaution to send a mechanic to Vallejo, and with the assistance of another air hose purloined from a freight car, the locomotive was fixed up again, and similar repairs made to the passenger car. As soon as possible the cars were run into the shop and pieces of pipe put in place in the hose.

Operations were continued, the other cars were equipped and put into service, but it was not long before the locomotive threw all the paper out of its commutators one Sunday afternoon. This was caused by the commutators getting hot, but principally by the high speed at which the locomotives were run. Ordinarily, the locomotive would get along all right during the week, but when put on a passenger run on Sunday with a trailer and run on the passenger schedule, at high speed, the commutators failed.

As a usual thing the road would operate nicely throughout the week, but we would usually have something happen on Sunday. One of the principal troubles was due to hauling trailers with the passenger cars. Nearly every time this was done, a circuit-breaker would burn up on a hill and stall the car until repairs could be made or a new circuit-breaker put upon the car.

It is undoubtedly true that we would not have been able to keep the road in operation if it had not been for the exceptionally experienced and capable motormen and conductors who were brought up from the Pacific Electric Railway of Los Angeles. These men learned their cars very quickly, and were able to start off sticking valves or stuck circuit-breakers with very little delay. I do not remember of a single case of a man being caught twice by the same thing. One thing that bothered them a great deal was the fact that the lights were taken off the same transformer as the air pump. If the transformer fuse should fail, the chances are that between the large amount of air used by the induction regulator and the amount used to set the brakes, that the pressure would be considerably reduced, so that the controller would be inoperative. With the controller inoperative and no lights, the motorman would naturally conclude that the juice was off, and would sit around and wait, without thinking of investigating the air pump fuse. As I said before, no motorman was caught more than once. There was always something new happening, and it kept us on the jump to get up remedies so as to keep ahead.

After about five months, new control devices arrived from the factory and were installed on the cars, with a great reduction of the trouble account. The new devices consisted of a set of unit switches arranged to connect the motors successively to different taps from the transformer, the transformer being connected to the line all the time. This control was operated with alternating current magnets on the air valves, the compressed air doing the work of moving the contacts. The cars operated very much better with this controller, and the motors were for the first time given a chance to show what they could do.

I ascribe most of this improvement to the fact that the induction regulator was done away with. This device undoubtedly had a great influence in keeping the power factor low, as all the current to the motors had to flow through it.

A great deal has been said about the fact that the road had been equipped with 700 volts trolley, and that this was the cause of much of the difficulties. I do not agree in this, because of the great improvement in the operation of the cars when provided with the different control system, and ascribe most of the difficulty to the use of the induction regulator. The cars with the new control device could be started on any hill on the road, which was something which could not be done before.

Later, the trolley voltage was raised to 3000 volts, and this is now in operation, but the change from the first control device to the second made a much greater improvement than the change from 700 volts to 3000.

Mention has been made that the gears were changed during the very first period of operation. This was due to the fact that the motors would not climb hills at all, and would start the cars very slowly on level.

The original specifications for this road called for three quadruple equipments equivalent to Westinghouse No. 76 motor, which is seventy-five horse-power, and two equipments equivalent to Westinghouse No. 38 B, which is fifty horse-power, nearly.

Motor curves were submitted and the armature speed proposed was considered excessive by the consulting engineer. It was then proposed that means be taken to reduce this speed, and the matter was referred to the factory. The factory proposed that the next size motor be used and operated at a slower speed, using properly proportioned gears, and an additional payment of $3,000 was agreed upon for this feature.

The motors thus furnished were normally 100 horse-power and were geared low so as to be called on for nominally seventy-five horse-power only, but the gear change makes them now 100 horse-power. The question now comes up, Does it take a 100 horse-power a. c. motor to do the same work as a seventy-five horse-power d. c. motor, because equal cars equipped with seventy-five d. c. motors are doing all that these cars can do.

The writer feels that the alternating current motor has made a good showing on this road, even when hedged around with a defective controller and an insufficient voltage supply, but even with all the improvements now made, what size is it? Do we have to buy a 100 horse-power a. c. motor to do the work of a seventy-five horse-power d. c. motor, because the a. c. motor has to carry a transformer along with it? The d. c. cars referred to weigh not to exceed thirty tons, and these cars weigh at least thirty-four tons. The additional four tons is quite an item, as it has to be carried all the time, and power is required to do so.

The alternating current motor does not exert a very powerful torque at starting, and we found that if we could get the motor to turn the wheels once, that we were all right. The motors would then accelerate nicely. The very first part of the start, however, is the weak point, and reminds one very much of the action of a single phase induction motor with shaded poles.

Another point about the motor is the presence of the resistance leads. It is essential that the starts be made promptly, and this point should be impressed on the motormen, as a considerable current flows in these resistance leads, due to the short-circuiting effect of the brushes. This point is very important in freight work, where it is necessary to start heavy trains.

With improved voltage and control, all these points become of less importance, but a knowledge of these limitations is of value. In handling heavy freight trains over bad places in the track or in starting, no particular harm is done if a d. c. locomotive should stall, provided the resistances are ample, but with this motor, steps should be immediately taken to see that the current is shut off promptly, or the resistance leads will get overheated.

Discussion by A. H. Babcock.

In the "Proceedings" for March, 1907, under the discussion of the Stilwell-Putnam paper, were published some operating costs as taken from the station log at Napa. These figures, although their accuracy was not disputed, were not taken as representing fair operating conditions.

In his criticism of them, Mr. Renshaw said that the load factor was necessarily very low, and that the polyphase generators in use at that time were not adapted for supplying single phase current; that when they were re-wound, operating conditions, especially in the conversion losses, would be improved.

In my published figures at that time, I showed that the cost of power per car mile was 6.92 cents, with three passenger cars and two work cars in operation. The records taken by the committee over the month of November, 1907, show a cost for power of 7.07 cents per car mile, with five cars and a locomotive in service. The efficiency of conversion from three-phase to single phase is 59.6 per cent.

In the period from March 1st to 13th, 1908, inclusive, the committee's figures show 7.32 cents per car mile for power, with eight cars and a locomotive in service, and an efficiency of conversion of 66 per cent. Apparently, then, the power costs per car mile increase with the load factor. At any time they are approximately double what they should be.

The motor-generators have been re-wound to supply single phase current.

In the curve showing the average kilowatt readings, taken on car No. 46, over one cycle from six hours, thirty-four minutes, fifteen seconds, to six hours, thirty-five minutes, twenty-seconds, the K. V. A. are given as well as the kilowatt readings.

Under the starting conditions, with sixty-five kilowatt input to the motors at 0.38 power factor, and 2720 volts at the motor, the line drop was 1103 volts, and the line energy loss, 69.5 kilowatts, or 51.7 per cent. Possibly this excessive line loss explains why the energy costs increase with the load factor.

Under running conditions at about six hours, thirty-five minutes, there was a line drop of 363 volts, an energy loss of 30.3 kilowatts on an input of 245 kilowatts to the motors, or 11.7 per cent energy loss on the line. The power factor at the car was then 0.931.

Averaged over the entire cycle named, the line drop is 483 volts, the averaged line loss 42.6 kilowatts, with an energy input of 218.2 kilowatts, or an energy loss of 16.3 per cent.

I am pleased to note in the figures of the committee a complete corroboration of the data as published by me in the "Proceedings" for March, 1907.

The results from the committee's figures, as stated above, are striking in more than one particular; in fact, the extraordinary conclusions which may be drawn legitimately from the committee's observations are so wholly obvious to thinking minds that further comment would be unnecessary, were it not that many of us, by reason either of lack of opportunity for investigation or absence of special training, are incapable of forming independent judgments, and ready-made opinions are easily absorbed. Many others naturally follow the majority, influenced largely, in many cases, by no deeper considerations than a desire to be up-to-date, and a dislike to be considered over-conservative.

For about four years the single phase railway system has been pushed actively into public notice. Engineers who have declined to experiment with it have been condemned as lacking in courage and in progressive spirit. In some cases, where the manufacturers have had the ear of those in control, they have secured the appointment of engineers more amenable to factory influence. Naturally one is apt to favor his friends.

Let those who have to make the decision as to how large amounts of other people's money are to be invested do little talking and much thinking. Quietly, and without the manufacturers' assistance, let them investigate the financial condition, business standing, and most important, the business and financial affiliations of those in control of properties around about which so much clamor has been raised. Let them search, not for the woman, but for him who really pays the bills. Then will become evident the reasons for "the results exceed our expectations" (a statement without meaning, unless the expectations are clearly specified), and the orders for additional equipments, so loudly announced. Above all, let them get at the cold facts as shown by the operating balance sheet, and see to it that all fixed charges are properly included. Here is the final test, always—does it pay; are the net earnings written in black or red ink.

It is my belief, based on several special investigations and much data accumulated over the entire country, that investigations of this kind, made thoroughly and without bias or pre-judgment, will show beyond a reasonable doubt, that while the single phase method of traction has a promising future and a very wide application when fully developed, he who buys it today deals in futures. Gambling always is unsafe. To play the other fellow's game, with someone else's money, is a breach of trust.

Discussion by Wm. F. Lamme.

Referring to the question of starting torque, there is a prevailing impression that the alternating current series motor will not deliver as much starting torque as the direct current motor. This is an error. Just as much starting torque can be secured from the alternating current series railway motor as from the direct current, but in order to secure this, a correspondingly large voltage should be applied. For example, if the power factory at start is 40 per cent and we apply 100 volts direct current to a motor, we will secure a certain torque. If the same torque is to be secured with alternating current, we must apply, not 100 volts alternating, but 250 volts alternating, that is 100 divided by 40 per cent, the power factor. Similarly, if we apply 200 volts direct current, we must apply 500 volts alternating current to get the same torque, and if we apply 400 volts direct current, we must apply 1,000 volts alternating current.

Please note that with a transformer upon the car, any tap necessary up to 3,000 volts can be applied to the alternating current motor, whereas with the direct current, we are limited to 500 volts. That is, with alternating current it is possible to secure a more rapid acceleration than with the direct current. Because we have not yet done this, it is no reason that it cannot be secured.

These remarks are given to refute the statements made that the alternating current motor **cannot** give the acceleration that is secured by use of the direct current motor.

As to the drop in voltage noted at one point in the curve, part of this drop can be accounted for by the ratio of transformation.

The voltage measurement was secured by taking a tap out of the working transformer upon the car, and this tap is upon the side of the transformer to which the motor is attached. This side of the transformer is worked the hardest, therefore it is not positively certain that the ratio of transformation is not increased and the voltage measurement is lower than the actual line voltage.

You note in the paper presented tonight, it is stated, that the generators of the motor generator sets were re-wound so as to deliver single-phase instead of two-phase. This means that the iron of the generator is not sufficient, and when a heavy load and very poor power factor is thrown upon one of these generators, the voltage drops, say from 110 volts on the voltmeter to 90 volts. This, I think, is the point at which the greater drop of voltage takes place. There is no reason to believe that the voltage drop, due to the line ever exceeds 600 volts. All of this drop is not energy drop. The ratio of total drop to energy drop is 1.7—1.8 to 1, so if the voltage drop is, say, 600, the energy drop is only 350.

MANUFACTURERS AT CATALINA ISLAND.

On Saturday, April 11th, the "Owl," the fastest train of the Southern Pacific Company, pulled out of the Oakland mole on one of the most important missions ever undertaken by that road. It involved the transportation from Oakland to Los Angeles of a merry party of Sons of Jove, all of them electrical manufacturers and jobbers, bent on a pleasure trip to Los Angeles and Catalina Island. That they missed their connection for Catalina Island at Los Angeles should not be considered a reflection on the Southern Pacific system, but must be laid entirely to an unruly box car which had left the track at a point near Saugus, necessitating the side-tracking of the entire party for several hours.

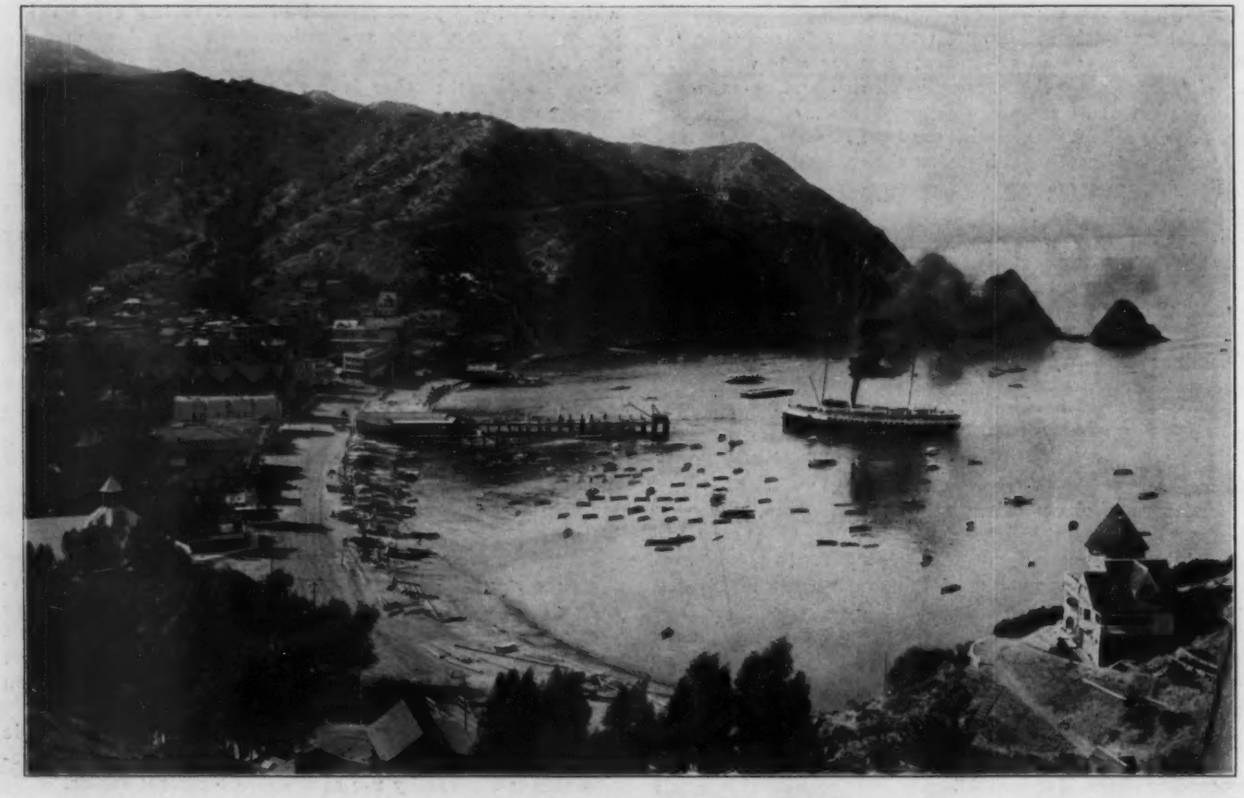
It is very probable that the party would still be side-tracked had it not been for the ingenuity displayed by Dr. H. C. Thaxter, who promptly supplied blue prints and specifications, the use of which resulted in returning the car to its original position on the track, releasing the side-tracked Owl and making it possible to continue the journey. As a result of this very successful piece of work, the doctor was appropriately decorated with California wild flowers, and given the additional title of Director-General and Chief Wrecker of the party, with full authority to handle all wrecks which might occur during the balance of the trip. For the time being, Director-General Thaxter was the cynosure of all eyes. Numerous women on the train requested introductions, and the arrival of the fleet was temporarily forgotten.

The party arrived in Los Angeles at about eleven a. m., and were met at the Arcade Depot by the Los Angeles Reception Committee, who promptly took them in charge, placed them in waiting automobiles and whirled them to the Jonathan Club, where, after removing the signs of travel, a preliminary discussion of certain subjects was held in the buffet, followed immediately by an informal luncheon. After luncheon, which was heartily enjoyed by all, a special car of the Pacific system took the entire party to Long Beach, where they registered for the night at the new Hotel Virginia, recently opened, and one of the handsomest in Southern California.

It being Palm Sunday, the afternoon and evening were devoted to such quiet pleasures as strolls upon the beach, discussions of Lenten matters, and various kinds of meditations on such thoughts as naturally arise during Lent. Before dinner Mr. Carter conducted the entire party to the bathing pavilion, where they were all refreshed by a dip in the surf. The dinner in the evening, while being simple and without ceremony, was thoroughly enjoyed by all, a separate table having been arranged for the party uniquely decorated with flowers and miniature incandescent lamps, an appropriate setting for a party of this character.

The host, Mr. D. M. Linnard, of the Hotel Virginia, took special pains to make the brief visit of the party a thoroughly enjoyable one, and his thoughtfulness and courtesy were greatly appreciated by all.

On Monday morning the party took the train for San Pedro. At this point began a most enjoyable outing, which rewarded the mystic members of the Rejuvenated Sons of Jove for their lengthy journeys from Seattle, San Francisco, and other Pacific cities, to the quiet waters of Catalina.



AVALON, CATALINA ISLAND, WHERE THEY MET.

The Sons from the north were met by the Los Angeles Joves at San Pedro, where the well equipped "Cabrillo" glided across the channel, sowing the flying fish on its way, to the peaceful harbor of Avalon. The voyage was enlivened by songs which welled from the hearts of those poetically inclined, and the melody of "We're Here Because We're Here," floated o'er the waters, to drive dull care away.

"Rus"—Rus Holabird, we mean, of course—who was Southern California's father to the gay clans, pointed the way to the headquarters at Hotel Metropole, which suddenly partook of the tone and life of the party from basement to casement on high.

As the evening paced on to eight o'clock, the banquet hall was opened, showing covers laid for the twenty and four guests who found at their plates most original and attractive menu cards, consisting of enclosed fuses emptied of their original contents and now containing a springed curtain with a legend of the feast to follow. On the outside the label "Feed Fuse" had been substituted for the customary one.

And until almost the midnight hour the flow of song, good-fellowship and other things drove care into hiding for many a day.

Allusion is made only as a matter of contrast to the sixteen errors in a certain baseball game at Monterey, for our genial toastmaster, Mr. Scribner made no errors at all during the enjoyable feast, showing his proficiency in the higher things of life; for many pleasant stories and toasts were suggested, and repartee in song and story betwixt the two ends of the table was both witty and hearty.

THE BUNCH.

Mr. Elliott, in a more serious vein, spoke with feeling of the advantage of these outings, in eliminating the personal element in competition between those engaged in similar lines, and establishing peace and good will in a friendly business rivalry.

THE BANQUET.

Among those absent were everybody except the following;

E. M. Scribner, of the Western Electric Company.

T. E. Bibbins, representing the General Electric Company.

Wm. S. Goodwin, of the Sterling Electric Company.

Walter M. Fagan, representing the Telephone and Electric Equipment Company.

B. W. Smith, of the American Steel and Wire Company.

Samuel W. Gilman and J. N. Clokitt, representing the J. A. Roebling's Sons Company.

H. V. Carter, from the Pacific Electric Works.

F. E. Corwin, representing the Bryant and Perkins Company.

Messrs. Chas. W. Scott and W. R. Greene, of the H. W. Johns-Manville Company.

Chas. C. Hudson, representing the Holabird-Reynolds Electric Company.

Albert H. Elliott, representing the National Electric Trades Credit Association.

R. D. Holabird, President of the Holabird-Reynolds Electric Company.

Frank Fowden, of the Brooks-Follis Electric Corporation.

E. N. Fobes, from the E. N. Fobes Co., Seattle.

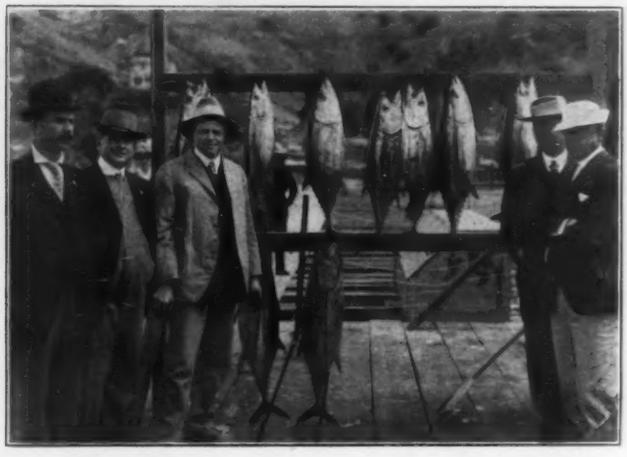
G. A. Knocke, of Dunham, Carrigan & Hayden.

Clem A. Copeland, representing the "Journal of Electricity, Power and Gas."

H. C. Thaxter, of the Standard Electric Company.

C. L. Gilson, representing the Crescent Electric Company, of Oakland.

H. G. Aylesworth, manufacturers' agent.



"BUTTON-AIRS" AND OTHERS, SMILES AND ALBICORE.

H. A. Sayles, representing the Holabird-Reynolds-Sayles Company.

C. C. Hillis, Treasurer and General Manager of the Electric Appliance Company.

Many arose early the next morning, notwithstanding the previous evening's festivities, to take advantage of the fishing afforded only by Catalina waters, and for which enthusiasts come from far away points of this and other countries.

And now we approach an event of island history which can be but faintly described, for how can we portray the gentle gradation of enthusiasm from indifference and even coolness towards the sport, to the proud moment of enthusiasm when Mr. Elliott landed his maiden albicore of 30 pounds in weight with a 9-ounce rod and a 9-thread line.

(Continued on page 262.)

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EDITORIAL.

THE CHELSEA FIRE.

Many of the people of Chelsea, Mass., have been made homeless and their business and public utilities rendered inoperative by a disastrous fire.

We of San Francisco, who know the terrors and hardships of such a great conflagration, can fully sympathize with them in their trouble. Not until we experience such a disaster do we realize how closely interwoven are our own lives with those of our fellows. Particularly is this true of a great fire which wipes out millions of dollars from the grand total of the world's improvements. These losses are the more regrettable, because, in general, they might be prevented by suitable precautions. Too often have the origin of these fires been unjustly ascribed to electricity, but in this case the electric lighting, traction, telephone and manufacturing interests were among the heaviest losers. The commendable foresight of some of the latter had provided a reserve set of machinery, which can be put into operation so soon that it will delay their productions but a few weeks, readily tided over by large stocks on hand in their outlying warehouses.

But even such foresight is not enough to compensate for great fire losses, for whose diminishment every public energy should have been directed. But as the deed is done, its remedy is what should now engross our attention. Having suffered ourselves, we understand the difficulties and appreciate the efforts of these stricken people to re-establish their homes and industries.

The "Journal of Electricity, Power and Gas" feels most deeply for them and offers its columns freely for notifying the world of their temporary locations and recording the work of re-building even a greater city. May all obstacles to progress be met by the indomitable spirit, which sees in great difficulties only a greater incentive to overcome them.

POLES.

Repeated warnings from the Forest Service regarding the rapid destruction of our available timber have caused pole users to cast about for a suitable substitute or preservative. In 1906 the telegraph, telephone and electric companies of the United States bought nearly three and one-half million of round poles, twenty feet or more in length. While this may form but a small proportion of the thirty-seven billion board feet of lumber produced that year, yet the decrease in the available supply of cedar and chestnut makes imperative immediate action to either conserve, preserve or substitute. Cedar is the best wood for poles, but the supply is being rapidly exhausted. Chestnut comes next in value, while small amounts of pine, cypress and redwood complete the list. The obvious remedy for their rapid destruction is the elimination of waste and the systematic replacing of timber removed. This is already being done with marked success, but so long has it been delayed that there will certainly come an interval when wooden poles will be at a premium, as the new crop cannot be grown soon enough to prevent a period of shortness.

Proper preservation promises to partially prevent this destruction. If a pole can be used for a longer time without replacement, fewer poles will be required. Its useful life can be extended by impregnating the wood with a chemical that will poison the fungi that causes decay. Just as a well-preserved old man is of more service in the successful conduct of a business than several green young men, so may a well-preserved old pole prove more efficient than a succession of unseasoned new timbers. The "elixirs of life" for timber include creosote, copper sulphate, zinc chloride and mercuric chloride, the first being the most effective. It is one of the bi-products of the production of coal gas, being distilled from the coal tar at a temperature between 400 to 700 degrees. As stated in a publication of the Forest Service, creosote made from tar produced in the oil-water-gas process and also from wood tar is not as good a preservative as the coal creosote.

The methods of applying creosote are being so rapidly improved that their details require the dignity of a special article treating of this live subject. The poles are usually seasoned with superheated steam, then soaked in creosote oil and placed under steam

pressure of at least forty-five pounds for at least four hours, being finally subjected to a vacuum until the sap ceases to flow.

Of the various substitutes, iron poles have probably been the longest in use. They are often compulsorily used in cities by electric railway companies, being made either of latticed iron or of wrought iron pipe, the latter usually being made in three or four sections and welded together. Electric light companies are using steel poles for arc lights, and long-distance, high-tension, transmission lines are being built with structural steel towers, the greater initial cost being compensated by their permanence and the greater span length permissible, which, together with the decreased auxiliary parts, such as cross arms and insulators, often make their use at least as economical.

But the latest claimant to our serious attention is the reinforced concrete pole, which has now proved to be superior after several years of severe trial. Being a single pole, they do not require the wide right-of-way necessary for towers, and they also eliminate the ever-present danger of short circuiting, that difficulty which is present wherever unprotected metal poles are used. Light poles for trolleys can be made at one place and distributed where needed, the larger ones being made horizontally on the ground, with their butts over the holes in which they are to be erected. These have proved elastic enough to withstand ordinary shocks and are almost entirely free from lightning troubles, as the reinforcing rods act as conductors. They are weatherproof, and, it is claimed, are longer lived and cheaper than steel.

While the success of these substitutes for wood, not only in pole construction but also in many other lines of structural requirements may exemplify human ingenuity in responding to necessity's demand, we should not lose sight of the fundamental necessity of correcting abuses of our natural resources that have caused such demand.

TRADE CATALOGUES.

Walter B. Snow, 170 Summer Street, Boston, Mass., has issued an attractive booklet on Productive Publicity, showing the advantages of a publicity engineer for engineering firms.

The Crocker-Wheeler Company, of Ampere, N. J., have issued several interesting bulletins. No. 95 is devoted to belt-type alternating-current generators, which are compactly built with light base to facilitate easy handling. No. 97 describes direct-current switchboard panels, Type 1, 125 to 250 volts, designed on the unit plan. No. 98 illustrates and describes Form L motors for outputs from 1/20 to 5 horsepower on 115, 250, or 500 volt direct-current circuits. Examples of the many uses to which this motor has been put are also shown. No. 99 is an interesting account of the various applications of Crocker-Wheeler motors in the Bethlehem Rail and Structural Mills. No. 100 shows Form I machines, belt type, direct current, motors 5 to 45 horsepower and generators 4½ to 40 kilowatts.

PERSONAL.

M. A. Farnsworth has established an office at 161 Second Street, San Francisco, retaining his shop and warehouse at 16 and 18 Natoma Street.

Mr. Edwin Fobes, of the Fobes Lamp Co., of Seattle, was in San Francisco one day last week on his way to the north from the jobbers' outing at Catalina Islands.

L. M. Hancock, mechanical engineer for the Fortuna Lighting Company of Fortuna, California, has returned home after a short visit to San Francisco.

G. I. Kinney is preparing to go East via Seattle to visit the companies he represents in San Francisco. These include the Northern Electric, the Fort Wayne Electric, and the Sprague Electric.

P. J. Aaron, manager of the Seattle branch of the Western Electric Company, is in San Francisco for a few days after a trip of six weeks through the manufacturing districts of the East. He reports that during his absence business at Seattle return to Seattle or remain in San Francisco and let the good return to Seattle or remainin San Francisco and let the good work go on.

REMOVAL NOTICE.

Crocker-Wheeler Company have moved into their new quarters at 32 Cortlandt Street, in the Cortlandt Building, Hudson Terminal, New York City. This 22-story building is the machinery headquarters of New York.

The executive offices of the Westinghouse Electric & Manufacturing Company, now at 111 Broadway, New York, N. Y., and the New York Sales Offices and Export Offices, of that Company now at 11 Pine Street, were removed on Monday, April 20, 1908, to the new City Investing Building, No. 165 Broadway, New York.

NOTICE OF ERRATA.

In the discussion on "Single Phase Railway," p. 236, issue of April 18, 1908, insert title "Joint Discussion by K. G. Dunn and Sidney Sprout" before last paragraph, second column.

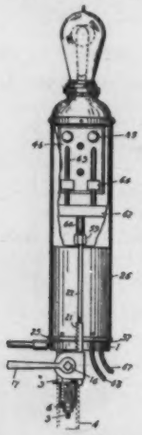
LECTURES ON RAILROAD ELECTRIFICATION AT THE UNIVERSITY OF MICHIGAN.

Mr. C. L. de Muralt, consulting engineer, and professor of electrical engineering at the University of Michigan, is giving a course of lectures to the senior electrical engineering students at Ann Arbor on the "Electrification of Steam Railroads." Prof. Muralt, who has been lecturing during the last semester on the underlying phases of this subject, such as the power station equipment, transmission and working conductors, motor characteristics, etc., intends to supplement these by a discussion of the technical and commercial features of the following subjects: (1) "The General Electrification Problem;" (2) "The Reasons for Electrification;" (3) "The Operating Characteristics of Steam and Electric Locomotives;" (4) "The Choice of Electric Systems;" (5) "An Analysis of the Cost of Operation; (6) "The Field of Railroad Electrification: The Congested Terminal, The Mountain Grade, and the Trunk Line," and (7) "Preparation of an Electrification Project for a Particular Road," special attention being directed to such problems as the design of locomotives, the calculation of run sheets, the choice of speeds, study of the peak load, the location of substations, the economics of transmission and other collateral topics.

PATENTS

ELECTRIC WATER HEATER. 884,343. Herbert N. Roche, San Francisco, Cal., assignor of one-half to Thomas B. Gray, San Francisco, Cal.

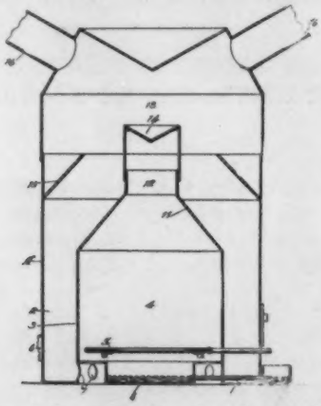
In an apparatus of the character described, the combination of a casing, a water conduit therein, an electric heating coil in conduit, a valve for controlling the passage of water



through conduit, and means for connecting heating coil with an electric circuit, comprising a stationary contact, a slidable rod contacting with a second contact and adapted to be moved into contact with the first contact and to be pressed thereon to provide a frictional resistance against the removal of slidable rod from contact, a stem for so moving slidable road, and a resilient connection between stem and rod.

GAS FURNACE. 883,880. Calvin P. Hensley and Frank H. Bryant, San Francisco, Cal., assignors to National Furnace Company, San Francisco, Cal.

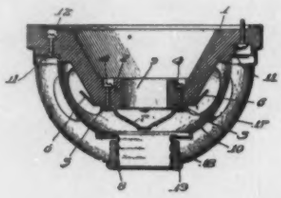
In a gas furnace, the combination of an outside cylindrical shell, an inside shell concentric therewith and separated therefrom to inclose an air passageway, inner shell inclosing a combustion chamber having draft inlets at the bottom opening



into passageway, and combustion chamber having a contracted outlet opening into the top of the furnace, a deflector arranged above inlet for radially distributing the heated particles rising from the combustion chamber, and a deflector in the form of a frustrum of a cone secured to the outer casing, and having its top terminating above the outlet from the combustion chamber and arranged to direct the hot air rising in passageway inwardly in counter-current to the heat passing through outlet from the combustion chamber, and a burner in the combustion chamber.

CLUSTER-LAMP SOCKET. 883,777. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill.

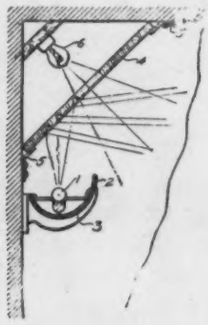
A plural lamp-holding device, comprising, in combination, a base, a lamp-receiving socket disposed to support a



lamp in a line passing through the axis of base, a center contact carried by base for socket, a series of sockets extending radially from base and each disposed to sustain a lamp in an oblique position relatively to base, a center contact carried by base for each of last-named sockets, and an outer casing provided with an opening opposite each of sockets.

ELECTRIC LIGHTING. 883,944. Walter C. Fish, Lynn, Mass., assignor to General Electric Company.

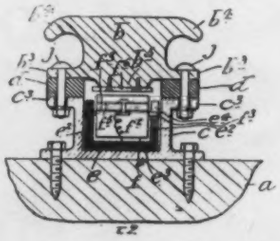
The combination, with a vapor electric lamp, of a light-transmitting reflector located in proximity thereto, and at



such an angle that light from vapor electric lamp will be reflected by reflector, and means for projecting light of a different color value through reflector to combine with the reflected light from vapor electric lamp.

THIRD-RAIL ELECTRIC RAILWAY SYSTEM. 884,170. Charles Kozesnik, New York, N. Y.

A third rail for electric railways consisting of separate hollow sections composed of top and bottom portions connected, but insulated one from another, the ends of the top

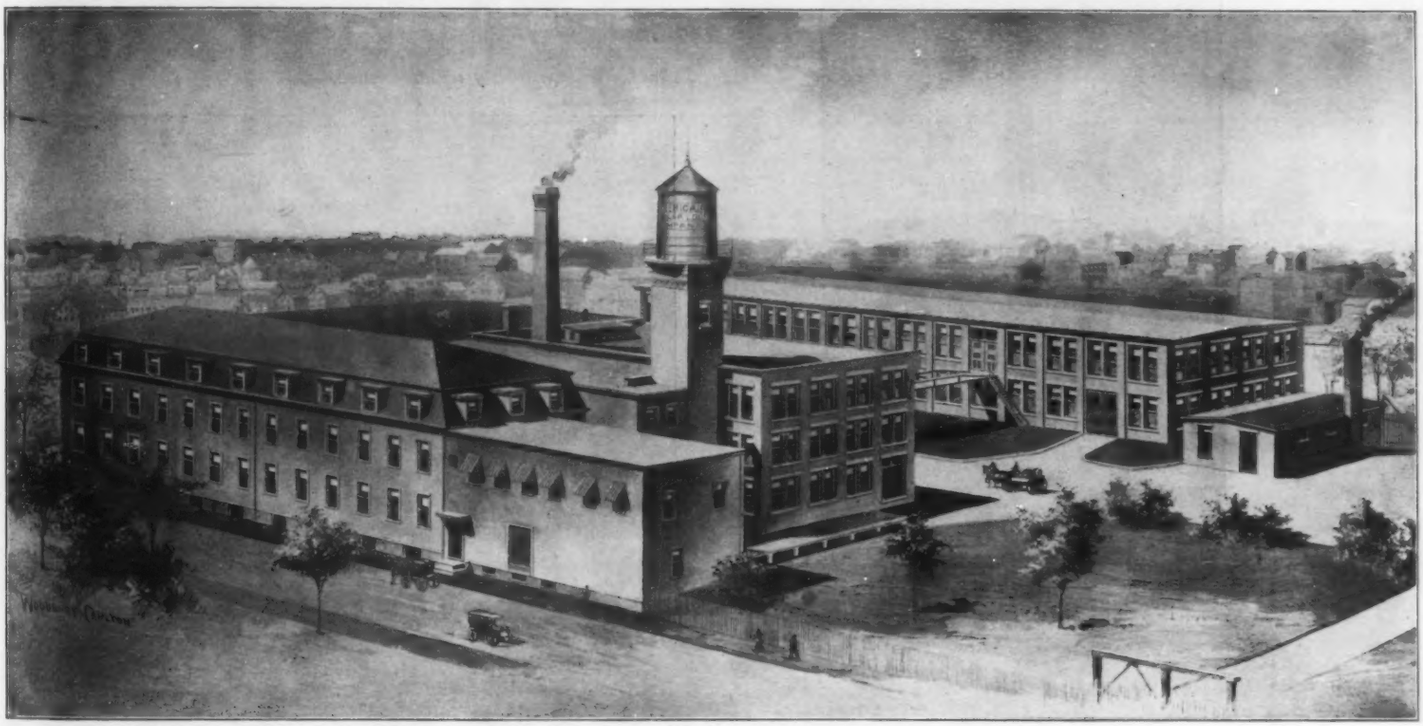


portions of sections being also insulated, the bottom of the top portions of the sections being longitudinally thickened or extended downwardly, and provided at intervals with contact devices, vertically movable armatures supported beneath contact devices and composed of separate end members, and a central contact member secured thereto, and an electrical connection for armatures.

INDUSTRIAL

THE CHELSEA CONFLAGRATION.

As a rule, disastrous conflagrations show no mercy to the electrical business. They give no consideration to the inconvenience to the general public which follows the destruction of electric light, street railway, telephone, and other property devoted to the electrical industry. The conflagration at Chelsea, Mass., a suburb of Boston, on Sunday morning, April 12th, was no exception to this rule. In a total loss of approximately $6,000,000, the various electrical interests suffered severely.



WORKS OF AMERICAN CIRCULAR LOOM CO., DESTROYED, CHELSEA FIRE.

The wire service was a complete wreck; fortunately the loss to the Chelsea Gas Light Company is confined largely to earnings, as most of the electric current in Chelsea is supplied by the Edison Electric Illuminating Company, of Boston. The loss to the Boston Elevated Railway and to the Boston and Northern Road was particularly heavy, while the Chelsea Exchange of the New England Telephone & Telegraph Company was destroyed, at a loss estimated at $20,000.

The plant of the American Circular Loom Company, manufacturers of circular loom flexible conduit, was totally destroyed; but we are advised by telegram that a complete duplicate set of machinery, which has always been held in reserve by them, will be installed in a new building and manufacturing resumed at the earliest possible moment. They estimate the delay at not to exceed two weeks. Their Pacific Coast agents, the John R. Cole Company, state that at their San Francisco and Seattle warehouses they have ample stock to keep the trade supplied for a much longer period, and additional stock in transit, and that the destruction of their factory will have no effect on Pacific Coast conditions.

Electroduct, the rigid conduit manufactured by the American Circular Loom Company, is made only at their Kenilworth, N. J., factory, and this branch of the business is therefore unaffected. Mr. A. T. Clark, president and general manager, and Mr. Alex Henderson, sales manager, of the American Circular Loom Company, have hosts of friends on the Pacific Coast, all of whom join in expressing regret at the disaster and congratulations on their ability to so quickly resume operations.

CEMENT TESTING SAND.

On account of the large increase in the cement business throughout the United States and the correspondingly large demand for Standard Cement Testing Sand, it has been found impossible to secure adequate and regular supplies of "Ottawa" sand from the East, this having hitherto been accepted as the standard. Supplies having virtually been cut off and there being an immediate prospect of much confusion in cement testing, the Standard Portland Cement Company (Davenport) has undertaken to supply a standardized local sand in the same manner as the Sandusky Portland Cement Company who standardize and supply the "Ottawa" sand.

It is only by the general acquiescence and support of the engineers and architects of the Coast that the local sand can become the recognized standard and the threatened confusion in cement testing avoided.

Many laboratories, mills, etc., are already entirely out of "Ottawa" sand and it is a matter of some urgency that a general expression of opinion be sent Smith, Emery & Company of San Francisco, inspecting, testing and chemical engineers.

A NEW MAXIMUM WATT DEMAND INDICATOR.

In many cases it is necessary to know the actual maximum watt consumption on alternating-current circuits, especially in motor installations.

To meet the demand for this type of instrument, the General Electric Company has just placed on the market an indicator designed to operate correctly within commercial limits on two or three phase circuits, with balanced or unbalanced, inductive or non-inductive loads. By proper connections, it may also be used on single-phase circuits.

This device is a modification of the "D-3" polyphase wattmeter, with both electrical elements acting on the top disc

5 AMP., 110 VOLT MAXIMUM DEMAND INDICATOR.

and a strong damping system acting upon the lower disc to provide the necessary time lag. In place of the usual register, there is provided a single graduated dial and two pointers. One of these is driven by the moving element through a train of gears, and indicates at any instant the energy passing through the device. The other pointer is driven by the first and remains at the maximum position reached by it, being held in this position by a ratchet. The final position reached by this second pointer indicates the maximum energy taken from the circuit. A thumb-nut is used to set the maximum demand pointer back to zero, and may be sealed to prevent tampering by unauthorized persons.

The length of time required for the pointer to reach its maximum position, or the "time lag," will depend on the torque of the motor elements and the strength of the damping magnets, and may be varied from one minute to thirty minutes. The indicator is rated by defining the time lag at 90 per cent of full scale, since between 90 and 100 per cent the movement is very slow compared with the speed from zero to 90 per cent.

The polyphase demand indicators are made self-contained in capacities from 25 to 150 amperes, 220 to 650 volts. Above these capacities, current and potential transformers must be used. The indicators are furnished with an all-metal cover finished in black japan.

MANUFACTURERS AT CATALINA ISLAND.

(Continued.)

A bronze medal lapel button was awarded for this distinction by the Catalina Light Tackle Club. But, hark! with the lark, as the first sunbeams burst into the next day, away to the albicore haunts sped the bronze button! And, returning as the noon approached! What! do we read the scales alright? Yes! A 36½-pound albicore, and a silver button is won by a pound and a half margin, and envy runs rampant.

For the fear of touching sunburnt spots we will not allude to the particular name of a party who took lunch a la carte wheels for six of them, spent ten more to the boatman, and lost light tackles to the tune of five dollars more with the sad final result of no fish.

Persistency, however, will always win; and the next day it was a Goodwin, for a 26-pound albicore was brought to the scales, earning for a deserving member the honor of a bronze button.

Messrs. Hillis and Holabird each were the recipient of bronze rewards for their having landed 33½ and 29¼ albicore with featherweight rods. And thus ended the second day of exciting times in the fish line, leaving behind the wrecks of many "light tackle," but a record withal which a party of equal numbers will probably never exceed.

SIMILAR.

Baseball was forgotten; golf was eschewed; meals grew cold and indifferent, but thirteen unlucky albicore were landed by the ten members, who became slaves to the art.

After witnessing the interesting spectacle of feeding the half dozen seals, which have become pets of the bay, with the surplus albicore the party mounted the Cabrillo for the mainland.

In the evening the festivities were brought to a reluctant close at Levy's Cafe, in the Angel City, by a meeting of the Sons of Jove.

Messrs. C. G. Pyle of the Standard Underground Cable Company, A. W. Ballard of the General Electric Company, Walter M. Fagan of the Telephone and Electric, T. B. Henley of the California Electric Co., and H. Conger Bowers of the F. E. Newberry Company, all of Los Angeles, were initiated into the order and rejuvenated in a fitting manner, after which a light banquet was served, felicitously presided over by Mr. Elliott, in his usually eloquent and finished fashion.

Mr. Grady, of the Faries Company, responded in an interesting manner, relating the early history of the organization, of which he was a charter member.

As the clock struck the wee-est hour of the night all was done and said, and with great sunburn and eclat good-byes of a happy throng blended with good-will and pleasing remembrances of days too quickly spent and with memories of "Auld Lang Syne" we parted to meet again, if fortune favors, sometime and somewhere, the time and place being only known to Jove and Sons. AMEN.

NEWS NOTES

TELEPHONES.

Crescent, Wash.—The Farmers' West Crescent Telephone Company is extending its line from Crescent to Curby.

Dayton, Wash.—A permit was granted A. M. Melcum to construct a telephone line along the county road.

Chehalis, Wash.—A telephone line is being built on the north fork of the Newaukum, which will be a great convenience to the farmers of that section.

San Rafael.—A petition received from D. Dolcini, asking permission to erect poles for a private telephone line between Ricky Hill and Nicasio, has been granted.

San Francisco.—The Home Telephone Company has been ordered by the Board of Works to tear up and reconstruct many of its filled trenches in the streets.

Camas, Wash.—The County Commissioners granted the Sunnyside Telephone Company a franchise along the county road from the Little Washougal bridge to Washougal.

Mesa, Wash.—The Farmers' Mutual Telephone Co. began the construction of a line from Mesa to Ringold recently, and will extend the line to Hanford later. Such a line has long been needed.

Montesano, Wash.—At the City Council meeting, C. H. Wolf, representing a Tacoma syndicate, petitioned for a telephone franchise, with the privilege of running service wires on all streets of the city.

Ephrata, Wash.—A further telephone convenience is to be constructed in the immediate future. A short long-distance line is to be built between Ephrata and Quincy, with but one intervening phone, to be located at Winchester.

Vashon, Wash.—The Vashon Island Telephone Company has been incorporated with H. Harrington president and T. Hanson secretary. The company is capitalized at $20,000, and extensive building operations have already begun.

Vacaville.—The ordinances granting to the Mutual Telephone Company, for the period of 25 years, the right to erect and maintain poles and wires for telephone purposes upon the streets and alleys of Vacaville, have been passed.

Coeur d'Alene, Ida.—Superintendent R. H. Hart, of the Rocky Mountain Bell Telephone Company, stated that the company within his district, Shoshone, Bonner and Kootenai Counties, is expending over $15,000 in improvements.

Stites, Idaho.—At a meeting held recently, P. E. Ellis, president of the Stites Telephone Company, organized a farmers' line, which will serve residents of Pleasant Valley. The Stites Company is a local co-operative association.

Gardner, Ore.—Money and rights of way are being subscribed to build a telephone line from Gardner to Scottsburg, the head of navigation, there to connect with the line from Drain. This will give this section of Oregon direct communication with the outside.

Portland.—The Portland Home Telephone Company will extend its lines into the suburbs soon. P. L. Willis is president of the company, and A. A. Andrews, general manager. The long distance facilities of the company will be increased, and connections completed with Tacoma.

San Francisco.—The Pacific Telephone & Telegraph Company is extending its two-number method of handling long distance business to include towns on the peninsula. Last week the system was made effective for handling calls between San Mateo and Burlingame and San Francisco.

Troy, Ida.—T. E. Wood, representing the Pacific States Telephone Company, has been in Troy working up a local exchange. So far, he has 27 phones pledged, and expects to install a first class system. The Pacific States will also take up and push the matter of phones into the country from Troy.

Virginia City, Mont.—The Ruby Valley Telephone Company has been organized for the purpose of building a telephone line from Alder to upper Ruby Valley points. At Alder the new telephone line will connect with the Buford line to Virginia City, and also with the Rocky Mountain Bell long distance telephone line.

Bellingham, Wash.—Announcement that about $20,000 will be expended in this city during the coming Summer in making improvements was made by Manager B. F. Reno, of the Sunset Telephone Company, following the visit of G. B. Robinson, general superintendent of company, of San Francisco, and A. H. Corcoron, division superintendent, with headquarters in Seattle. Two days were spent in going over the city, and it was decided to start the work as soon as possible.

Port Angeles, Wash.—The telephone lines covering the territory in the east end of Clallam County, and heretofore owned and operated by the Independent Telephone Company, have been taken over by the Angeles Telephone & Telegraph Company and consolidated with the lines of the local company, whose system is gradually being extended to cover the entire county. A new line is now under construction westward from this city, which will connect Lake Crescent with all the long-distance lines during the coming summer.

LIGHT AND POWER PLANTS.

Seattle, Wash.—A petition by the Seattle-Tacoma Power Company to erect and maintain poles for a 30,000-volt transmission line from the intersection of the company's present line and Beacon Avenue and Hanford Street to the intersection of the company's present line and Lander Street, has been granted.

Columbus, Mont.—Articles of incorporation of the Columbus Electric Light Company filed in the office of the County Clerk. The company is formed for the purpose of furnishing light and water to the residents of the city of Columbus and the places of business of that city. The company is capitalized at $20,000, and the directors of the company are Dr. James Craig, Henry Grant, William Cook, W. E. Anderson and H. I. Raiff.

ELECTRIC RAILWAYS.

Hanford.—Bids will be received till May 4th for the electric railway franchise applied for by F. S. Granger.

San Diego.—The ordinances granting railway franchises to E. W. Peterson in South San Diego have been passed by the County Board of Supervisors.

Riverside.—Manager W. W. Pool, of the Southern California Cement Company, states that he hopes that the trolley line from Riverside to Crestmore will be completed by May 1st.

Reno.—Promoters of the electric line to Steamboat Springs say the line will not be ready for operation until September. They are also figuring on extending it eventually to Jumbo, the new mining camp on the west side of the Virginia City range.

Santa Cruz.—General Manager F. E. Fitzpatrick, of the Coast Counties Power Company, says that the Sequel extension will be completed to the corporate limits within the present year. Another steam turbine is to augment the capacity of the plant at the beach.

American Falls, Idaho.—Assurance has been given settlers on lands under the American Falls canal, a project covering 65,000 acres between Blackfoot and American Falls, that an electric line will be built in the course of a year to connect the above-mentioned cities, and thus afford the settlers of this rich tract railroad facilities.

Los Angeles.—That work on the new electric railway between Los Angeles and Pasadena will begin within the next few months is foreshadowed by demolition of the old Pasadena elevated cycleway. Horace M. Dobbins, of Pasadena, is promoter of both the cycleway and railway projects. The estimated cost of the railway will be $2,500,000.

New Westminster, B. C.—Electric locomotives with a possible speed of sixty miles an hour will be the motive power employed by the British Columbia Electric Company on the new line from the city to Chilliwack. The line will be formally opened on May 24, 1910, and tenders are now being invited for the building of the powerful electric engines that will haul the first trains over the road.

Portland, Ore.—Requests for franchises to build street car lines on many streets in the outlying districts, so as to serve the growing suburban territory with new lines, will be made within the next few days by President Josselyn, of the Portland Railway, Light & Power Company. The council will be asked to permit the laying of tracks throughout a large district on the East Side, where the growth of population has outdistanced the car lines.

Oakland.—An extension of the Key Route system, including the establishment of a passenger and freight depot in the block bounded by Twelfth, Fourteenth, Union and Poplar Streets, and contemplated service over Twelfth Street through the heart of the city into Hayward and adjacent suburban territory, are indicated by the activity of agents of the corporation in securing subscribers to a petition for a right of way along Poplar Street, and in the purchase of all the property in the block designated. Connection with the Emeryville pier will be had by a line along Poplar Street, extending south from Twenty-second.

Oakland.—By a resolution passed by the Oakland Board of Public Works, the Oakland Traction Company is directed to widen the distance between its tracks on Broadway, between First and Fourteenth Streets. A protest was entered on behalf of the Traction Company by its representative, Engineer Boggs, who endeavored to delay action by the city on the plea that the company's finances would not permit of the work being done at this time. Mr. Boggs submitted blue prints and figures showing that to widen the distance from 9½ feet to 11 feet between the centers, as on other streets, would necessitate an expenditure of from $50,000 to $70,000, and also result in the suspension of all traffic on lower Broadway while the work is in progress. Mr. Boggs suggested the opening of Washington Street for the operation of cars, thereby lessening the burden of travel on Broadway. He said his company had been considering the plan for two years, but thought they ought to be allowed to derive some further service out of the expenses put into lower Broadway already.

FINANCIAL.

Lodi.—The election to determine whether or not the city shall issue bonds in the sum of $50,000 for a sewer system and $76,000 for a water and light system will be held May 4th instead of May 5th.

Bakersfield.—The directors of the Associated and Amalgamated Oil Companies held a meeting in the company's offices at Kern River last week. It was decided to call a dividend of $1 a share per month on the 50,000 shares of the Amalgamated. This means an annual dividend of $600,000.

San Francisco.—The first official statement of the loss in gross earnings sustained by the United Railroads Company during the strike of last year is contained in a brief annual report of President Calhoun, which has just been made public. His report of gross earnings for 1907 shows $4,745,116, as compared with $5,955,786 in 1906, a decrease of $1,210,670. This latter sum is, therefore, the loss in gross receipts alone, caused by the strike which began May 5th and continued until late in the fall. The expense the company was put to in fighting the strikers is not set forth.

ILLUMINATION.

The California State Board of Prison Directors have decided that more light is needed at Folsom, and it was decided to advertise for bids for the construction of a $6,000 additional electric plant. Bids will be received on May 11th.

San Francisco.—The final payment of $5 per share with six months' interest has been made on the Mutual Electric Light Company's certificates. The third payment of $5 per share with six months' interest was also made on the extended certificates of this company.

Riverside.—Estimates are now being received by the Beaumont Land and Water Company for the complete equipment of a pumping plant, to be installed at Beaumont. The machinery wanted is one 60-horsepower gasoline engine; one Ingersoll-Sargent air compressor, 60-horsepower; one oil storage tank, capacity 1 carload, together with pipes, fittings, etc.

INCORPORATIONS.

Los Angeles.—The Electric Equipment Company has been incorporated with a capital stock of $20,000.

Los Angeles.—Articles of incorporation have been filed by the Mono Lake Oil Company with a capitalization of $2,000,000.

Honolulu.—At the last meeting of the Board of Directors of the Hawaiian Electric Company it was decided to double the capacity of the present plant.

San Francisco.—The St. Lawrence Oil Company has been incorporated by A. Y. Hardenburgh, M. L. Friedlander, and J. D. Lederman. The capital stock is $100,000.

San Francisco.—The Camino Real Water Company has been incorporated with a capital stock of $200,000 by M. D. DeLaney, S. Foster, and R. A. Orett. The principal place of business is San Francisco.

Bakersfield.—Articles of incorporation have been filed by the Loveland Oil Company with a capitalization of $25,000. The incorporators are E. H. Loveland, T. W. Helm, G. T. Kinkade, C. A. Lee and others.

Bakersfield.—The Kern Mutual Telephone Company has filed articles of incorporation with a capital stock of $25,000. The directors are H. W. Thomas, J. T. McGuire, T. S. de Lacy, F. G. Munzer and R. Galloway.

Visalia.—Articles of incorporation have been filed by the Blacherns Water Company with a capital stock of $10,000. The directors are W. P. Bartlett, Grace Redfield, V. D. Knupp, A. E. Brooks, and Jacob Sturm, all of Porterville.

Redlands.—Articles of incorporation of the Standard Gas & Electric Company have been filed with the County Clerk. The capital stock is $50,000, and the principal place of business is Los Angeles. The directors are Walter S. Camp, Horace Slater, and R J. Dunn.

Chico.—J. W. Roper, of the Midas Gold Mining Company, operating in Shasta County, states that the company will spend between $40,000 and $50,000 in the erection of a power plant on Bee Gum Creek, to generate power for the mine, which will be seven miles distant from the power house. The company has filed on 5,000 miner's inches of water. About 800 horsepower will be generated at first, but this will in time be increased to 2,000 horsepower.

TRANSMISSION.

Ukiah.—Superintendent Irving H. Brush, of the Ukiah Water & Improvement Company, reports that the company will install a 60 horsepower electric pumping plant at its station on Russian River.

Oakland.—The Stanislaus Electric Power Company is commencing to erect towers near Midway and through the hills of Alameda County, according to a statement made a few days ago by I. B. Parsons, who has been securing a right of way for the power lines through this part of the county.

Nevada City.—Chief Engineer Downing, of the Pacific Gas & Electric Company, is at this place to inspect officially all the company's plants in the county. The plant on Deer Creek is practically ready for operations. When the water is turned on it will generate about 8,000 horsepower, and the electricity will be carried to the valley and bay towns.

TRANSMISSION.

Portland, Ore.—Contracts have been let to the Risdon Iron Works, San Francisco, for a large quantity of steel pipe for the penstocks at the power station now being built by the Mount Hood Railway & Power Company at Bull Run.

Wenatchee, Wash.—J. M. Duffy and O. B. Fuller have closed contracts with the Wenatchee Electric Company for power to run the motors on their land west of the city, with which they will pump water for irrigation. Mr. Duffy will have a 25-horsepower motor, and Mr. Fuller will have a 7½-horsepower.

Orient, Wash.—The application of Arthur Phillips and H. D. Merritt for a franchise to operate and maintain a system of water works in the streets and alleys of Orient, and giving them the right to erect and use wires for conveying electricity for light and power along the public highways in Ferry County, was heard and granted by the board of county commissioners.

Wenatchee, Wash.—T. Clark, ex-Mayor Schebe, and Marvin Chase have ordered the machinery for the power plant they will install in the Wenatchee Valley this summer. They formed the Valley Power Company a year ago, but nothing definite has been done to establish the company until recently. The company intends to develop an enormous water-power proposition on the Wenatchee River, five miles above Cashmere.

Seattle, Wash.—The Seattle-Tacoma Power Company recently obtained a permit to erect a two-story brick power station at 1319-1323 Western Avenue. It will adjoin the transformer house of the same company, and machinery will be installed to generate 1,500 horsepower. Facilities are provided for doubling the capacity when desired by the installation of a duplicate of the new palnt. Excavations have been made, piles driven, and the concrete is now being poured into the wall frames.

Helena, Mont.—Without warning, the great dam at Hauser Lake, on the Missouri River, 15 miles north of this city, partially gave way recently, causing a damage estimated at $250,000. The Hauser Lake dam, which was one of the finest structures of its kind in the world, was completed last year, at a cost of more than $2,000,000, and developed a horsepower of 25,000, which was utilized in operating the various power plants in Helena and the Butte mines and the Amalgamated Copper Company's smelter plants at Anaconda.

POWER AND LIGHT.

Berkeley.—Berkeley is to have a competing electric light company, according to an announcement made by Samuel L. Napthaly, consulting engineer for the San Francisco City Electric Light Company.

Las Vegas, N. M.—An electric light plant will be installed in the near future at the Territorial penitentiary. A combination engine and dynamo has been ordered from the Westinghouse Electric Company, and is expected to arrive some time in April.

ELECTRIC RAILROADS.

Eugene, Ore.—The Oregon Electric is going to build south at once to Eugene. This has been confirmed by Guy Talbot, general manager of the road.

Vancouver, B. C.—The British Columbia Electric Railway Company has sent out a survey party to run a line up Lynn Valley for a distance of about six miles.

Tacoma, Wash.—An ordinance giving the Puyallup Valley Northern Rapid Transit Company the right to enter the city, has been introduced. This is the old Chambelain Company, whose franchise was allowed to lapse. The new franchise covers all the rights granted in the first one.

Walla Walla, Wash.—The County Commissioners have granted a franchise to the Washington & Oregon Traction Company to construct and operate an electric railway along the edge of the cemetery. The company must start construction by the first of the year, and have the road completed by January 1, 1910.

New Westminster, B. C.—Managing Director J. Buntzen, of the British Columbia Electric Railway, has made the announcement that tenders will be called for at once for the construction of that portion of the new Chilliwack electric line between this city and Cloverdale, and work on grading and track-laying will be commenced within a month.

Spokane, Wash.—A. M. Dewey, of Spokane, is projecting an electric railway from Spokane to Omak, Okanogan County, Wash., 200 miles, to connect with the proposed Okanogan Electric Railway, thus shortening the distance between Spokane and the Puget Sound country and the Canadian Northwest, by 100 miles. Mr. Dewey is the promoter of the Okanogan Electric Railway Company, which has franchises, right of way and a charter for a steam or electric railway covering much of the mining district in Okanogan County.

San Francisco.—The special committee of the Board of Supervisors—Messrs. Jennings, Murphy, Broderick and Johnston—who were appointed to select experts to investigate the affairs of the San Francisco Gas & Electric Company preliminary to fixing the rates for the coming fiscal year, have definitely engaged A. M. Hunt to do the engineering work, and Charles D. Stuart to expert the books and accounts of the corporation. The total outlay for the work is not to exceed $2,000.

Chicago.—Permanent headquarters of the International Independent Telephone Association were opened in Chicago with the idea of inaugurating a policy of aggressiveness that the organization expects will put a new complexion upon the telephone situation in America. For the first time in the history of the Independent telephone movement and the organization of the association there is a salaried president and a salaried secretary, both of whom, with a corps of assistants, will devote their entire time to organization and field work.

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